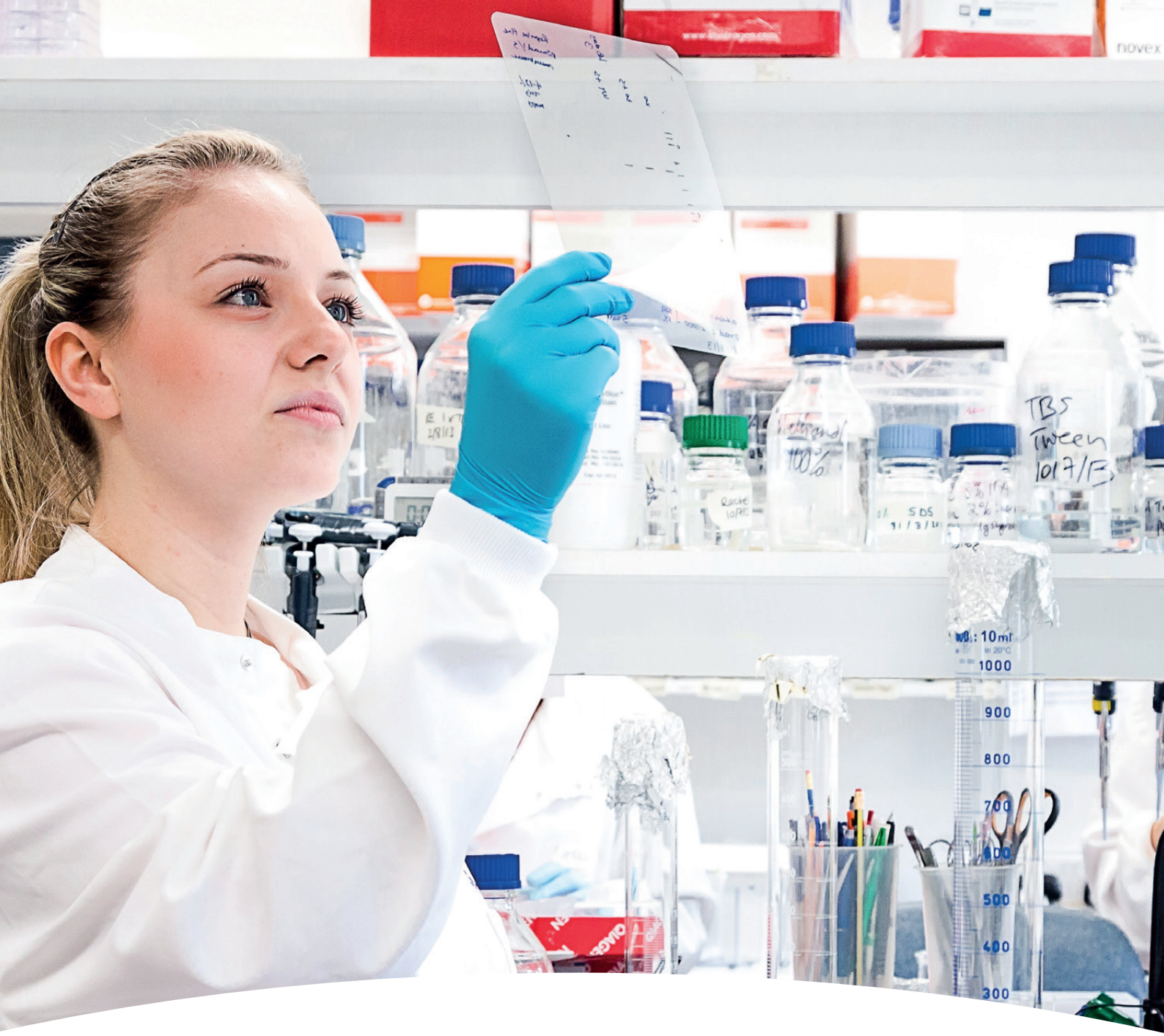


INVESTMENT AND IMPACT: HOW GOVERNMENT SUPPORTS SCIENCE IN THE UK

WE WILL BEAT CANCER SOONER

CANCER RESEARCH UK

Professor Nic Jones, Chief Scientist, Cancer Research-UK, Director, Manchester Cancer Research Centre

"The ultimate goal is to prevent, control and cure all cancers and the only thing that will get us there is research. We know more about cancer than ever before – and that's why we've seen cancer survival rates double in 40 years.

That's proof that research works but we want to do even more and get things moving even faster.

We want to create research environments that will attract the brightest scientific minds to work in the UK. And once we've got the critical mass you need, we'll get people rubbing shoulders, swapping ideas and amazing things will start to happen"

Sue Spencer, patient

"I was diagnosed with breast cancer at the age of 47, three years before the age at which screening starts, and nine months after I had seen my mother in law die from the same disease. Her battle suddenly became my battle and I felt in a desperate struggle to survive for my 10 year old daughter.

Following two surgeries, I enrolled on the TACT2 chemotherapy trial and the SUPREMO radiotherapy trial.

My mother in law died 4 years after diagnosis but I have lived for 7 years. Research has created better treatments so that I have survived to see my daughter start university."

ABOUT CANCER RESEARCH UK

Cancer Research UK is the world's largest independent cancer charity dedicated to saving lives through research.

We support research into all aspects of cancer through the work of over 4,000 scientists, doctors and nurses. In 2013/14, we spent £386 million on research in institutes, hospitals and universities across the UK – including the £35 million contribution we made to the Francis Crick Institute.

We are a leading funder of clinical research in the UK, supporting around 250 clinical studies. This includes early diagnosis, prevention and epidemiological research, as well as clinical trials of investigational medicinal products. In 2013/14, over 27,000 cancer patients were enrolled onto Cancer Research UK supported trials.

EXECUTIVE SUMMARY

The UK has a world-leading research base and a celebrated history of success in science. Investing in medical research supports breakthroughs that can help us to prevent and cure disease; it supports jobs in the UK and delivers significant returns to the economy.

Cancer Research UK does not receive any Government funding for our research; our work to bring forward the day when all cancers are cured is made possible due to the overwhelming generosity of our supporters. However, Government investment is critical for creating a supportive environment for research.

Government funding for science provides the vital infrastructure needed for research to take place in UK universities and hospitals and supports the training of our scientists and clinicians. It leverages further investment in UK science by providing the foundations on which industry and charities can invest.

At the forthcoming Spending Review, it is vital that Government continues to support UK science.

£198m GOVERNMENT INVESTMENT THROUGH THE CHARITY RESEARCH SUPPORT FUND IN 2014, LEVERAGED £805m SPEND BY CHARITIES IN ENGLISH UNIVERSITIES.

Since 2010, the science budget has had flat cash protection. This has maintained the UK's position as a place to do science during difficult economic circumstances. However, sustained investment is needed to maintain the UK's world-leading reputation: grow our scientific community; and deliver both the health and economic benefits of scientific discovery to the whole population.

We call on the Government to commit to maintain the science budget in real terms across all Government departments at the next Spending Review.

TWO THIRDS OF CANCER RESEARCH PUBLICATIONS IN 2011 RELIED ON MULTIPLE FUNDERS.

This report showcases three examples of interventions that are preventing, treating and curing cancer. It outlines the road to their development and the contribution of the different sectors of UK science: from the underlying 'basic' research that tested the scientists' original idea, through to the clinical studies that tested their safety and effectiveness, and finally, their adoption in the NHS.

EVERY POUND SPENT BY GOVERNMENT ON R&D, INCREASES PRIVATE SECTOR R&D OUTPUT BY 20P EVERY YEAR.

Along this pathway, we highlight the crucial investments by Government that made the development of these interventions possible.

For more information please call us on **0203 469 8360**, tweet **@CRUK_Policy** or email **publicaffairs@cancer.org.uk**

THE DEVELOPMENT OF BOWEL SCOPE SCREENING FOR BOWEL CANCER

There are around 40,000 new cases of bowel cancer in the UK every year, resulting in 16,000 deaths. It is the fourth most common cancer. Bowel Scope screening can catch this cancer early and save lives.

Bowel Scope screening uses a flexible tube with a camera and a light on the end to look into a patient's lower bowel. It can spot both early-stage cancers and pre-cancerous growths known as 'polyps,' which can be immediately removed to prevent them developing into cancer.

SOURCES

- Government
- Charity
- Industry

CLINICAL DEVELOPMENT

1998

Pilot study on 3,500 patients showed that Bowel Scope could be safe and well accepted.[1]

INFRASTRUCTURE

- Hospitals and GP practices in Welwyn Garden City, Leicester and Harrow
- Imperial College London
- University College London

FUNDING

- Medical Research Council
- NHS Research & Development
- Cancer Research UK
- KeyMed

2000

Study on 4,400 people showed that 99% were glad to have had the test, 91% reported mild or no pain, and 97% said they felt little or no embarrassment.[2]

INFRASTRUCTURE

- Hospitals and GP practices in Welwyn Garden City and Leicester
- Imperial College London
- University College London

FUNDING

- Medical Research Council
- Cancer Research UK

2010

Study on 170,000 people showed that for those aged between 55 and 64, Bowel Scope reduced people's chances of developing bowel cancer by a third and reduced the death rate from bowel cancer by 43%.[3]

INFRASTRUCTURE

- Hospitals and GP practices in 14 regions of the UK (11 in England, two in Wales, one in Scotland)
- Imperial College London

FUNDING

- Medical Research Council
- National Institute for Health Research*
- Cancer Research UK
- KeyMed

ADOPTION & UPTAKE

Feb 2011

Analysis showed that Bowel Scope screening was most effective when performing a one-screen on 55-60 year olds.[4]

INFRASTRUCTURE

- School of Health and Related Research (ScHARR), University of Sheffield

FUNDING

- NHS Cancer Screening Programme

Apr 2011

UK National Screening Committee recommended that Bowel Scope be introduced to the NHS Bowel Cancer Screening Programme.[5]

Jan 2012

The Department of Health published plans to introduce Bowel Scope into the NHS in England Bowel Cancer Screening Programme in six pilot areas from March 2013.[6]

IMPACT

Bowel Scope screening has the potential to prevent thousands of people in the UK from developing and dying from bowel cancer and could save the NHS around £300 million each year.

PREVENTING THOUSANDS OF BOWEL CANCER DEATHS IN THE UK

MAKING SAVINGS TO THE NHS THROUGH REDUCING TREATMENT COSTS

THE DEVELOPMENT OF VEMURAFENIB, A TARGETED THERAPY FOR SKIN CANCER

Malignant melanoma is the fifth most common cancer in the UK and its incidence is increasing. Unlike most other cancers, around a quarter of cases are diagnosed in those under 50.

If detected at an early stage, simply removing the melanoma is likely to be curative. However, the outlook for patients with advanced melanoma - where the cancer has spread to other parts of the body - is less promising as there are few treatment options available. Research supports the development of new treatment options, such as Vemurafenib, for these patients.

SOURCES

- Government
- Charity
- Industry

BASIC RESEARCH

2002

Researchers found that a significant proportion of skin cancer patients had a mutation in their BRAF gene. This mutation is called V600E. They speculated that drug could be developed to target this mutation and treat these patients.

The mutant BRAF gene was patented as a target for drug screens and patient tests. All 5 named inventors were UK-based scientists.[1]

INFRASTRUCTURE

- The Wellcome Trust Sanger Institute
- The Institute of Cancer Research
- Universities and hospitals across the UK

FUNDING

- The Wellcome Trust
- Cancer Research UK
- Breakthrough Breast Cancer

Early 1990s

Researchers published information about the structure of BRAF. This information enabled companies worldwide to design drugs that would be able to target BRAF.[2]

INFRASTRUCTURE

- The Institute of Cancer Research
- The Wellcome Trust Sanger Institute

FUNDING

- Cancer Research UK
- The Wellcome Trust
- Astra-Zeneca

CLINICAL DEVELOPMENT

2004

2011

The phase III BRIM3 trial found that Vemurafenib improved rates of overall and progression-free survival in patients with previously untreated melanoma with the BRAF V600E mutation.[3]

INFRASTRUCTURE

- International trial involving the Royal Marsden Hospital London and University of Manchester

FUNDING

- Roche
- National Institute for Health Research*

ADOPTION & UPTAKE

Apr 2011

The European Medicines Agency decided to conduct an accelerated assessment of Vemurafenib.

Dec 2011

EMA granted marketing authorisation for Vemurafenib.[4]

Dec 2012

National Institute for Health and Care Excellence issue guidance recommending Vemurafenib for the treatment of malignant melanoma for patients with the BRAF V600 mutation.[5] The Scottish Medical Consortium approved Vemurafenib in 2013.

IMPACT

Research has shown that Vemurafenib, a targeted treatment for patients with advanced melanoma, can prolong life by months and relieve the symptoms of disease.

It's estimated that globally over 12,000 patients were treated with Vemurafenib in the period from launch to 31st July 2013.

MONTHS OF LIFE GAINED AND SYMPTOMS RELIEVED

AN ESTIMATED 12,000 PATIENTS TREATED WORLDWIDE

THE DEVELOPMENT OF INNOVATIVE RADIOTHERAPY FOR CANCER PATIENTS

Around 4 out of every 10 people with cancer have radiotherapy as part of their treatment. However, as well as killing cancer cells, radiotherapy can cause damage healthy cells that surround a tumour.

Intensity-modulated radiotherapy (IMRT) targets the radiation beams more precisely to the shape of the tumour, delivering a high dose to the cancer and limiting the exposure of surrounding healthy tissue. This can reduce the side effects of treatment for cancer patients and improve outcomes.

SOURCES

- Government
- Charity

BASIC RESEARCH

1982

Intensity modulated radiotherapy (IMRT) was first described began by a research group based in Stockholm.

Early 1990s

Several labs around the world developed different techniques to deliver IMRT.

1989

Researchers in the UK developed a method to compute radiotherapy beam profiles for IMRT.[1]

INFRASTRUCTURE
- Institute of Cancer Research
- Royal Marsden Hospital

FUNDING
- Cancer Research UK

CLINICAL RESEARCH

2007

A clinical trial showed that breast cancer patients who received IMRT showed less changes in breast appearance than those who received traditional 2D radiotherapy.[2]

INFRASTRUCTURE
- Royal Marsden Hospital
- Institute of Cancer Research

FUNDING
- Cancer Research UK
- South West Thames Regional Health Authority
- Royal Marsden Hospital Clinical Research Fund

Jun 2009

The PARSPORT trial showed that head and neck cancer patients were less likely to experience side effects such as dry mouth when they received IMRT compared to traditional radiotherapy.[3]

INFRASTRUCTURE
- Hospitals across the UK, locations included London, Surrey, Stoke-on-Trent, Cambridge, Ipswich and Manchester.

FUNDING
- Cancer Research UK
- National Institute for Health Research

ADOPTION & UPTAKE

2007

The National Radiotherapy Advisory Group (NRAG) noted the potential of IMRT in its report advising ministers on how to develop a world-class radiotherapy service in England.[4]

Nov 2009

After reviewing the evidence, the NHS National Cancer Action Team in England published a guide for commissioners recommending the use of IMRT for a number of cancers, including breast and head and neck cancer.[5]

2012

Government launched the Radiotherapy Innovation Fund – initially £15 million, but later boosted to £23 million - to help NHS Trusts in England provide more patients with access to advanced radiotherapy.

IMPACT

Research has shown that IMRT can improve outcomes for cancer patients and cause less side effects when compared to traditional radiotherapy.

The Radiotherapy Innovation Fund has seen the number of patients in England receiving IMRT rise from 14% in 2013 to over 35% in 2014. This is still slightly short of the estimated number of patients that would benefit from receiving IMRT. IMRT is available in the devolved nations however data on its uptake is currently not available.

21%
INCREASE
IN NUMBER OF PATIENTS RECEIVING IMRT IN ENGLAND

35%
OF PATIENTS
NOW[6] RECEIVE IMRT IN ENGLAND

REFERENCES

EXECUTIVE SUMMARY

1. Higher Education Funding Council for England annual funding allocations.
2. OHE and SPRU, 2014, Exploring the Interdependencies of Research Funders in the UK.
3. Haskel. J., Hughes., and Bascavusoglu-Moreau. E., 2014, The Economic Significance of the UK Science Base.

BOWEL SCOPE

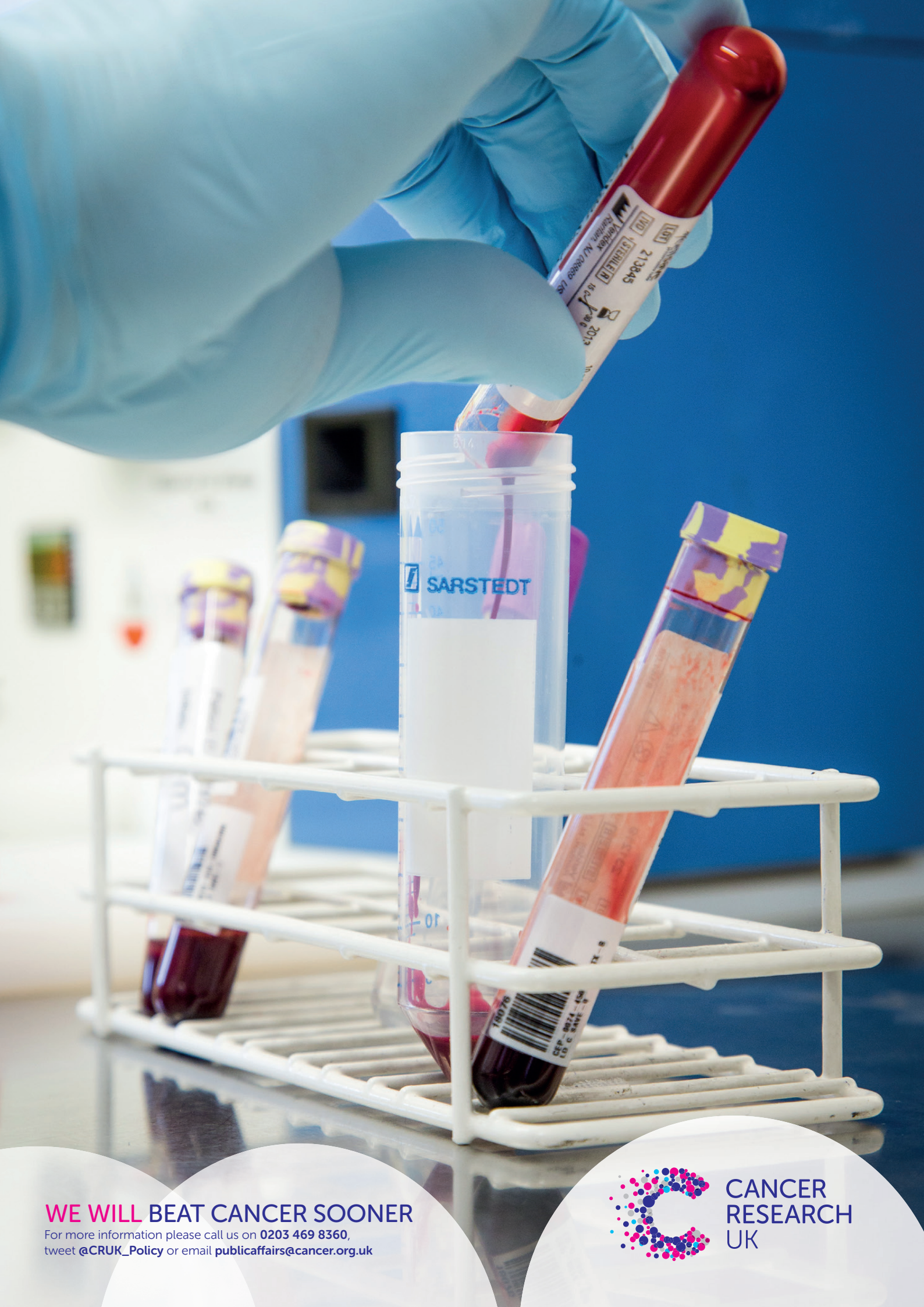
1. Atkin. WS, 1993. 'Prevention of Colorectal Cancer by Once-Only Signmoidoscopy'. The Lancet. Vol.341:(8847) pp736-740
2. Taylor. T, 'Acceptability of Flexible Sigmoidoscopy Screening in Older Adults in the United Kingdom'. Journal of Medica Screening. Vol.7(1) pp 38-45
3. http://www.thelancet.com/journals/lancet/article/PIIS0140-673 6(10)60551-X/abstract
4. Whyte. S, Report for the NHS Bowel Cancer Screening Programme: Re-appraisal of the Options for Colorectal Cancer Screening. University of Sheffield School of Health and Related Research.
5. Maryor. S. 2011. UK Committee Recommends Flexible Sigmoidoscopy to Screen for Bowel Cancer. BMJ. Vol.342 pp 1
6. Department of Health/ NHS Bowel Screening Programmes. 2012. NHS Bowel Screening Programme: Piloting of Flexible Sigmoidoscopy (FS) - Advice to the NHS and Bidding Process.
7. York Health Economics Consortium. 2007. 'New report examines costs and outcomes of treatment for bowel cancer'. University of York.

VENERAFINIB

1. http://www.nature.com/nature/journal/v417/n6892/full/nature00766.html
2. Cancer Genome Project, 2004. 'Mechanism of Activation of the RAD-ERK Signalling Pathway of Oncogencic Mutations of B-RAF'. Cell Press. Vol.116:(6) pp 855-867
3. Chapman. P et al. 2011. 'Improved Survival with Vemurafenib in Melanoma with BRAF V600E Mutation' The New England Journal of Medicine. Vol.364 pp 2507-2516.
4. National Institute for Health and Care Excellence. 2015. Vemurafenib for Testing Locally Advanced or Metastatic BRAF V600 Mutation- Positive Malignant Melanoma.

IMRT

1. Webb. S., 1989. 'Optimisation of Conformal Radiotherapy Dose Distribution by Simulated Annealing'. Phys Med Biol Vol.34:(10) pp 1349-1370.
2. Donovan. E, et al. 2005. 'Randomised Trial of Standard 2D Radiotherapy (RT) Versus Intensity Modulated Radiotherapy (IMRT) in Patients Prescribed Breast Radiotherapy'. Radiotherapy and Oncology. Vol.82:(3) pp 254- 264
3. Nutting. C, et al. 2009. ' First Result of Phase III Multicenter Randomized Controlled Trial of Intensity Modulated (IMRT) Versus Conventional Radiotherapy (RT) in Head and Neck Cancer'. Journal of Clinical Oncology. Vol.27:(18S)
4. National Radiotherapy Advisory Group. 2007. Radiotherapy: Developing a World Class Service for England.
5. NRIG Technology Sub-Group Report. 2009. Intensity Modulated Radiotherapy (IMRT): A Guide for Commissioners. NHS National Cancer Action Team.
6. Ellison. T and Ball. C. (2015). Monitoring IMRT Delivery in the UK. NATCANSAT.



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